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ENVIRONMENT

Mr. Steven Scharf, P.E.
New York State Department of Environmental Conservation (NYSDEC)
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7015

Subject:
Results of First Quarter 2015 Groundwater Monitoring,
Operable Unit 2, Northrop Grumman Systems Corporation and Naval Weapons Industrial Reserve Plant (NWIRP) Sites, Bethpage, New York.
(NYSDEC Site #s 1-30-003A and B)

Date:
May 26, 2015

Contact:
David Stern

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631.391.5284

Email:
david.stern@arcadis-us.com

Our ref:
NY001496. 314I.NAVI4

Dear Mr. Scharf:

On behalf of Northrop Grumman Systems Corporation (Northrop Grumman), ARCADIS is providing the NYSDEC with the validated results of Operable Unit 2 (OU2) groundwater monitoring, performed in accordance with the approved Groundwater Monitoring Plan (ARCADIS of New York, Inc. 2012) and the Public Water Supply Contingency Plan (PWSCP) (ARCADIS G&M, Inc. 2003). Table 1 summarizes OU2 remedial system performance operational data and water balance. Tables 2 and 3 provide the validated analytical results of monitoring for this period. Figure 1 shows the site plan with well locations.

Please contact us if you have any questions or comments.

Sincerely,

ARCADIS of New York, Inc.

David E. Stern
Senior Hydrogeologist

Enclosures

Copies:
Ed Hannon – Northrop Grumman
Fred Weber – Northrop Grumman
Walter Parish – NYSDEC Region 1
Steven Karpinski – New York State Department of Health
Michael Alarcon – Nassau County Department of Health
Joseph DeFranco – Nassau County Department of Health
Lora Fly – NAVFAC Midlant Environmental
David Brayack – TetraTech NUS, Inc.
Roger Smith – Glenn Springs Holdings, Inc.
Kevin Lumpe – Steel Equities
Thomas Taccone – USEPA
Doug Garbarini - USEPA
Robert Alvey – USEPA
Carol Stein-USEPA
Matthew Russo – Town of Oyster Bay
Stan Carey – Massapequa Water District
Charles Prucha – South Farmingdale Water District
John Reinhardt – Town of Hempstead Water District
Matthew Snyder – New York American Water
Michael Boufis – Bethpage Water District
Lois Lovisolo – Bethpage Public Library (Public Repository)
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Table 1. Operational Summary for the On-Site Portion of the Operable Unit 2 Groundwater Remedy, First Quarter 2015, Northrop Grumman Systems Corporation, Bethpage, New York. [1]

Identification	Quarterly Flow Rates (gpm)		Quarterly Flow Volumes (MG)			Quarterly VOC Concentrations (µg/L)		VOC Mass Removed (lbs) [7]
	Design [2]	Average [3,4,13]	Design [2]	Actual [3,4]	% of Design	TCE [5]	TVOC [5,6]	Quarterly
Influent Groundwater								
Well 1	800	804	104.8	102.2	98%	713	770	658
Well 3R [12]	700	1,014	91.7	131.6	144%	493	590	635
Well 17 [11]	1,000	1,011	131.0	124.5	95%	191	240	244
Well 18	600	611	78.6	76.9	98%	55.9	79	50
Well 19	700	722	91.7	89.9	98%	175	210	154
Total	3,800	4,162	498	525	105%	--	--	1,741
Effluent Groundwater [8]								
Calpine	100 - 400	200	--	24.7	--	--	--	--
OXY Biosparge [10]	2 - 42	3.8	--	0.5	--	--	--	--
West Recharge Basins	1,112 - 1,455	1,640	--	214.9	--	--	2.40	--
South Recharge Basins	2,231	2,175	292.4	285.0	97%	--	1.17	--
Total	--	4,019	--	525	--	--	--	--
Treatment Efficiencies [9]								
Tower 96 System Efficiency:	99.3%							
Tower 102 System Efficiency:	>99.9%							

See footnotes on next page

Table 1. Operational Summary for the On-Site Portion of the Operable Unit 2 Groundwater Remedy, First Quarter 2015, Northrop Grumman Systems Corporation, Bethpage, New York. (1)

Notes:

(1) Quarterly reporting period: January 05, 2015 through April 06, 2015

(2) "Design" flow rates were determined for the five remedial wells and for the South Recharge Basins based on computer modeling (ARCADIS G&M, Inc. 2003c, modified in April 2005). Flow rates for Calpine, OXY Biosparge and West Recharge Basins are typical flow rates and are provided for reader information. "Design" flow volumes represent the volume of water that should be pumped/discharged during the reporting period and is calculated by multiplying the design rate by the reporting period duration.

(3) "Average" flow rates for the remedial wells represent the average actual pumping rates when the pumps are operational and do not take into account the time that a well is not operational. During this reporting period, the remedial wells operated for the following percentage of the time: Well 1 (97%), Well 3R (99%), Well 17 (94%), Well 18 (96%), and Well 19 (95%). "Actual" volumes are determined via totalizing flow meters.

(4) "Average" flow rates for the system discharges represent the average flow rate during the entire reporting period and are determined by dividing the total flow during the reporting period by the reporting period duration. The Calpine and South Recharge Basins flow volumes are determined via totalizing flow meters. The West Recharge Basin flow is calculated by subtracting the cumulative flow to the other discharges from the total influent flow. Actual flow to the recharge basins are greater than shown because storm water combines with the plant effluent prior to discharge to the recharge basins.

(5) The TCE and TVOC concentrations for the remedial wells are from the quarterly sampling event performed during this reporting period on March 16, 2015 (Table 2).

(6) The TVOC concentration for the two sets of recharge basins are their respective monthly SPDES concentrations averaged for the current quarter.

(7) TVOC mass removed for the reporting period is calculated by multiplying the TVOC concentration from the quarterly sampling event and the quantity of water pumped during the reporting period.

(8) There are five discharges for the effluent groundwater: South Recharge Basins, West Recharge Basins, Calpine, OXY Biosparge system, and minor losses (pipe loss, irrigation use). Treated water is continuously discharged to the south and west recharge basins, and is available "on-demand" to both the Calpine Power Plant (Calpine) for use as make-up water, and the biosparge remediation system operated by Occidental Chemical (OXY Biosparge).

(9) Treatment System Efficiencies are calculated by dividing the difference between the influent and effluent TVOC concentrations by the influent concentration.

(10) The flow rate and volume for OXY Biosparge (Occidental Chemical) were estimated based on the average pumping rate calculated from data from April 2007 through March 2012.

(11) Well 17 upgrade (including installation of new VFD, sampling port and other appurtenances) was performed on January 8, 9, 14 and 15 with minimal downtime. Well 17 was brought online with VFD on remote control on January 14, 2015 at a flow rate of 998 gpm.

(12) A Well 3R pilot study was started on July 14, 2014 in an effort to increase the VOC mass removal through an increased pumping rate to approximately 1,000 gpm. The TVOC concentration and mass removal have increased since the initiation of the pilot study. Well 3R was brought online December 2013 to replace Well 3 due to decreasing specific capacity at Well 3 indicative of imminent well failure.

(13) Total pumpage/recharge rates are accurate to -/+ 15% due to limitations in metering. Flowmeter calibration is planned.

Acronyms:

--	Not Available or Not Applicable	gpm	gallons per minute	SPDES	State Pollutant Discharge Elimination System
TVOC	Total Volatile Organic Compounds	TCE	Trichloroethene	NG	Northrop Grumman Systems Corporation
µg/L	micrograms per liter	lbs	pounds	NYSDEC	New York State Department of Environmental Conservation
OU2	Operable Unit 2	MG	Million Gallons	VPGAC	Vapor Phase Granular Activated Carbon
		VOC	Volatile Organic Compounds	VFD	Variable Frequency Drive

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Table 2. Concentrations of Volatile Organic Compounds in Groundwater Remedial Wells and Treatment Systems, First Quarter 2015, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

Constituent (Units in µg/L)	Well: / Sample ID: / Date:	WELL 1 / WELL 1 / 3/16/2015	WELL 3R / WELL 3R / 3/16/2015	96 EFFLUENT / T96 EFFLUENT (GW) / 3/16/2015	WELL 17 / WELL 17 / 3/16/2015	WELL 18 / REP-031615-KV / 3/16/2015	WELL 18 / WELL 18 / 3/16/2015	WELL 19 / WELL 19 / 3/16/2015	102 EFFLUENT / T102 EFFLUENT (GW) / 3/16/2015
1,1,1-Trichloroethane		**0.48 J**	**1.1**	< 1.0	**0.58 J**	**0.69 J**	**0.73 J**	**0.50 J**	< 1.0
1,1,2,2-Tetrachloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		**0.94 J**	**1.8**	< 1.0	**1.3**	**1.3**	**1.3**	**0.86 J**	< 1.0
1,1-Dichloroethene		**3.5**	**6.0**	< 1.0	**3.0**	**3.7**	**3.9**	**1.8**	< 1.0
1,2-Dichloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**0.40 J**	< 1.0
1,2-Dichloropropane		**5.1**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Butanone (MEK)		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
2-Hexanone (MBK)		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
4-methyl-2-pentanone (MIK)		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Acetone		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10 J
Benzene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Bromomethane		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon Disulfide		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon tetrachloride		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane		< 1.0	**0.66 J**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform		**0.27 J**	< 1.0	< 1.0	**0.42 J**	**0.24 J**	< 1.0	**0.51 J**	< 1.0
Chloromethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-dichloroethene		**4.9**	**8.1**	**0.44 J**	**4.3**	**2.1**	**2.2**	**20.6**	< 1.0
cis-1,3-dichloropropene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Tetrachloroethene		**40.9**	**44.2**	< 1.0	**36.9**	**14.1**	**13.9**	**8.0**	< 1.0
Toluene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,2-dichloroethene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,3-dichloropropene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene		**713 D**	**493 D**	**4.0**	**191**	**54.1**	**55.9**	**175**	< 1.0
Trichlorotrifluoroethane (Freon 113)		**5.7**	**6.1**	< 5.0	**6.0**	**1.8 J**	**1.0 J**	**1.0 J**	< 5.0
Vinyl Chloride		< 1.0	**29.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene-o		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes - m,p		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total VOCs [(1)]		**770**	**590**	**4.4**	**240**	**78**	**79**	**210**	0

Notes and Abbreviations:

(1) Results rounded to two significant figures.

Results validated following protocols specified in OU2 Groundwater Monitoring Plan (ARCADIS 2012).

Bold	Constituent detected
VOCs	Volatile Organic Compounds
µg/L	Micrograms per liter
J	Constituent value is estimated
D	Concentration is based on a diluted sample analysis
REP	Field replicate
<5.0	Compound not detected above its laboratory quantification limit.
OU2	Operable Unit 2

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Table 3. Concentrations of Site-Related Volatile Organic Compounds in Outpost Wells, First Quarter 2015, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in µg/L)	Well: / Sample ID: / Date:	BPOW 1-1 / BPOW 1-1 / 2/4/2015	BPOW 1-2 / BPOW 1-2 / 2/3/2015	BPOW 1-3 / BPOW 1-3 / 2/3/2015	BPOW 1-4[1] / BPOW 1-4 / 3/20/2015	BPOW 1-5[1] / BPOW 1-5 / 3/20/2015	BPOW 1-6[1] / BPOW 1-6 / 3/23/2015	BPOW 2-1 / BPOW 2-1 / 2/5/2015	BPOW 2-2 / BPOW 2-2 / 2/6/2015
1,1,1-Trichloroethane		**0.27 J**	**0.28 J**	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2,2-Tetrachloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1-Dichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1-Dichloroethene		**0.22 J**	**0.23 J**	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,2-Dichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Carbon tetrachloride		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chlorobenzene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chloroform		**0.097 J**	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
cis-1,2-dichloroethene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
trans-1,2-dichloroethene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethene		**1.1**	**0.62**	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Site-Related VOCs [3]		**1.7[4]**	**1.1[4]**	0.0	0.0	0.0	0.0	0.0	0.0
TVOC Trigger Value [6]		**0.6**	**0.6**	**0.6**	NE	NE	NE	NE	NE

See last page for notes.

Table 3. Concentrations of Site-Related Volatile Organic Compounds in Outpost Wells, First Quarter 2015, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in µg/L)	Well: / Sample ID: / Date:	BPOW 2-3 / BPOW 2-3 / 2/6/2015	BPOW 3-1 / BPOW 3-1 / 2/4/2015	BPOW 3-2 / BPOW 3-2 / 2/5/2015	BPOW 3-3[1] / BPOW 3-3 / 3/24/2015	BPOW 3-4[1] / BPOW 3-4 / 3/31/2015	BPOW 4-1R[2] / BPOW 4-1R / 3/30/2015	BPOW 4-1R[2] / BPOW-R (REPLICATE) / 3/30/2015	BPOW 4-2R[2] / BPOW 4-2R / 3/27/2015
1,1,1-Trichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2,2-Tetrachloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	**0.61**	< 0.50	< 0.50	< 0.50
1,1-Dichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1-Dichloroethene		< 0.50	< 0.50	< 0.50	< 0.50	**0.39 J**	**0.36 J**	**0.38 J**	**0.39 J**
1,2-Dichloroethane		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**0.12 J**	< 0.50	**0.10 J**
Carbon tetrachloride		< 0.50	< 0.50	< 0.50	< 0.50	**0.76**	**0.17 J**	**0.18 J**	**0.12 J**
Chlorobenzene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chloroform		< 0.50	< 0.50	< 0.50	< 0.50	**1.1**	**0.13 J**	**0.14 J**	< 0.50
cis-1,2-dichloroethene		< 0.50	< 0.50	< 0.50	< 0.50	**0.86**	**0.23 J**	**0.17 J**	**0.19 J**
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)		< 1.0	< 1.0	< 1.0	< 1.0	**0.48 J**	**10**	**9.9**	**5.2**
Tetrachloroethene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
trans-1,2-dichloroethene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethene		< 0.50	< 0.50	< 0.50	< 0.50	**64.2 D**	**0.79**	**0.78**	**0.78**
Total Site-Related VOCs [3]		0.0	0.0	0.0	0.0	**68**	**12** [5]	**12** [5]	**6.8**[5]
TVOC Trigger Value [6]		NE	**1.5**	**1.5**	NE	NE	**1.5**	**1.5**	**1.5**

See last page for notes.

Table 3. Concentrations of Site-Related Volatile Organic Compounds in Outpost Wells, First Quarter 2015,
Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

Notes and Abbreviations:

Samples analyzed for site related VOCs per the PWSCP (ARCADIS G&M, Inc. 2003) using USEPA Method 524.2

(1) Wells BPOW1-4, BPOW1-5, BPOW1-6, BPOW 2-3, BPOW3-3, and BPOW3-4 are currently monitored by Northrop Grumman on a voluntary basis. The screen intervals for these wells were selected by the Navy based on data obtained from vertical profile borings VP-127 (BPOW-1 cluster), VP-130 (BPOW 2-3) and VP-128 (BPOW-3 cluster).

(2) The NAVY abandoned original Wells BPOW4-1 and BPOW4-2 and installed replacement Wells BPOW4-1R and BPOW4-2R between August, 2014 and October, 2014.

(3) Site-related VOCs were established in the Public Water Supply Contingency Plan (PWSCP) (ARCADIS G&M, Inc. 2003).

(4) The TVOC Trigger Value for Cluster 1 was initially exceeded on April 23, 2004; confirmatory sampling and reporting was conducted as per the PWSCP (ARCADIS G&M, Inc. 2003).

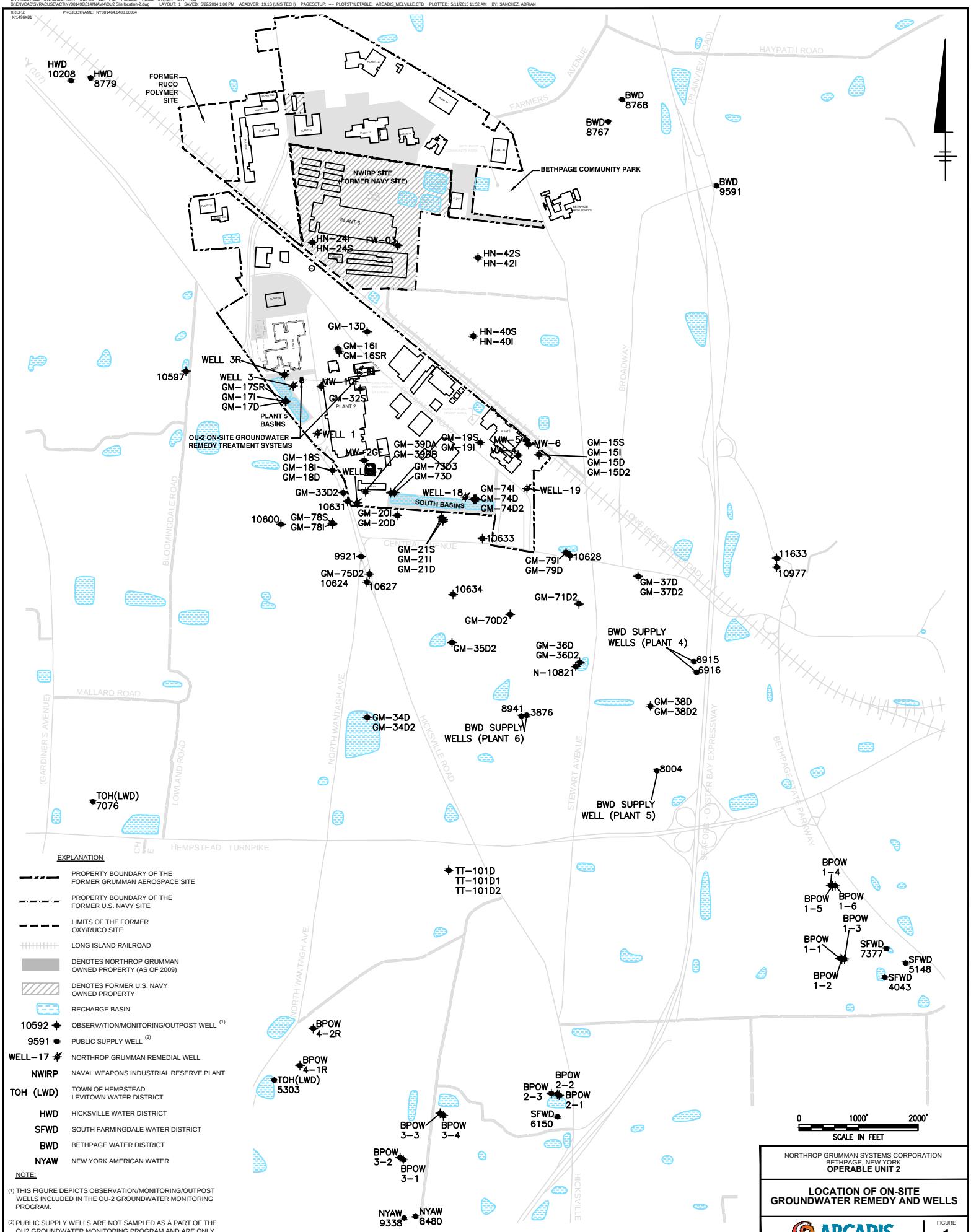
(5) The TVOC Trigger Value for BPOW 4-1 was initially exceeded on March 1, 2012; confirmatory sampling and reporting was conducted as per the PWSCP (ARCADIS G&M, Inc. 2003).

(6) TVOC Trigger Values were established for Wells BPOW1-1, BPOW1-2, BPOW1-3, BPOW3-1, BPOW3-2, BPOW4-1, and BPOW4-2 in the PWSCP (ARCADIS G&M, Inc. 2003). Established trigger values have been previously exceeded (except for BPOW 3-1 and BPOW 3-2) and no longer apply as the goal of the PWSCP has been met.

Total Site-Related VOCs rounded to two significant figures.

Bold value indicates constituent detected.

D	Concentration is based on diluted sample analysis
J	Constituent value is estimated
NE	Not Established
TVOCs	Total Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
µg/L	micrograms per liter
<0.5	Compound not detected above its laboratory quantification limit



EXPLANATION

- PROPERTY BOUNDARY OF THE FORMER GRUMMAN AEROSPACE SITE
- PROPERTY BOUNDARY OF THE FORMER U.S. NAVY SITE
- LIMITS OF THE FORMER OXY/RUCO SITE
- LONG ISLAND RAILROAD
- DENOTES NORTHROP GRUMMAN OWNED PROPERTY (AS OF 2009)
- DENOTES FORMER U.S. NAVY OWNED PROPERTY
- RECHARGE BASIN
- 10592 — OBSERVATION/MONITORING/OUTPOST WELL (1)
- 9591 — PUBLIC SUPPLY WELL (2)
- WELL-17 — NORTHROP GRUMMAN REMEDIAL WELL
- NWIRP — NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
- TOH (LWD) — TOWN OF HEMPSTEAD LEVITOWN WATER DISTRICT
- HWD — HICKSVILLE WATER DISTRICT
- SFWD — SOUTH FARMINGDALE WATER DISTRICT
- BWD — BETHPAGE WATER DISTRICT
- NYAW — NEW YORK AMERICAN WATER

NOTE:

(1) THIS FIGURE DEPICTS OBSERVATION/MONITORING/OUTPOST WELLS INCLUDED IN THE OU-2 GROUNDWATER MONITORING PROGRAM.

(2) PUBLIC SUPPLY WELLS ARE NOT SAMPLED AS A PART OF THE OU2 GROUNDWATER MONITORING PROGRAM AND ARE ONLY USED FOR REFERENCE.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 2

LOCATION OF ON-SITE GROUNDWATER REMEDY AND WELLS

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FIGURE 1